CLAIMS

1. A high-tensile-strength steel excellent in high temperature strength, characterized by containing, in mass, C at not less than 0.005% to less than 0.08%, Si at not more than 0.5%, Mn at 0.1 to 1.6%, P at not more than 0.02%, S at not more than 0.01%, Mo at 0.1 to 1.5%, Nb at 0.03 to 0.3%, Ti at not more than 0.025%, B at 0.0005 to 0.003%, Al at not more than 0.06%, and N at not more than 0.006%, with the balance consisting of Fe and unavoidable impurities.

2. A high-tensile-strength steel excellent in high temperature strength according to claim 1, characterized by said steel satisfying the expression $p \geqq -0.0029 \times T + 2.48$ when the steel temperature T (°C) is within the range from 600°C to 800°C, wherein p is a stress drop ratio (a yield stress at a high temperature/ a yield stress at room temperature) that is obtained by a yield stress normalized by using a yield stress at room temperature.

3. A high-tensile-strength steel excellent in high temperature strength according to claim 1, characterized in that: said steel comprising a single structure composed of bainite or a composite structure composed of ferrite and bainite at room temperature; the temperature (Ac_1) at which said structure reversely transforms into austenite during high temperature heating corresponding to a fire higher than 800°C; and said steel satisfies the expression $p \geqq -0.0029 \times T + 2.48$ when the steel temperature T (°C) is within the range from 600°C to 800°C, wherein p is a stress drop ratio (a yield stress at a high temperature/ a yield stress at room temperature) that is obtained by converting a yield stress normalized by using a yield stress at room temperature.

4. A high-tensile-strength steel excellent in high temperature strength according to claim 1, characterized

in that, in the high temperature range from 600°C to 800°C: said steel has such a strength as to satisfy the expression $p \geqq -0.0029 \times T + 2.48$ when the steel temperature T (°C) is within the range from 600°C to 800°C, wherein p is a stress drop ratio (a yield stress at a high temperature/ a yield stress at room temperature) that is obtained by converting a yield stress normalized by using a yield stress at room temperature; said steel has a structure wherein the temperature (Ac_1) at which a single structure composed of bainite or a composite structure composed of ferrite and bainite at room temperature reversely transforms into austenite during high temperature heating corresponding to a fire is higher than 800°C; one or more of carbonitrides precipitated phases thermodynamically stable in said single structure composed of bainite or in said composite structure composed of ferrite and bainite is not less than 5×10^{-4} in terms of a molar fraction; and the total amount of Mo, Nb and Ti that dissolve in the ferrite structure is not less than 1×10^{-3} in terms of a molar concentration.

5. A high-tensile-strength steel excellent in high temperature strength according to claim 1, characterized in that, in the high temperature range from 600°C to 800°C: said steel has such a strength as to satisfy the expression $p \geqq -0.0029 \times T + 2.48$ when the steel temperature T (°C) is within the range from 600°C to 800°C, wherein p is a stress drop ratio (a yield stress at a high temperature/ a yield stress at room temperature) that is obtained by converting a yield stress normalized by using a yield stress at room temperature; said steel has a structure wherein the temperature (Ac_1) at which a single structure composed of bainite or a composite structure composed of ferrite and bainite at room temperature reversely transforms into austenite during high temperature heating corresponding

to a fire higher than 800°C; the average circle equivalent diameter of prior austenite grains in said steel is not more than 120 μm; one or more of carbonitrides precipitated phases thermodynamically stable in said single structure composed of bainite or in said composite structure composed of ferrite and bainite is not less than 5×10^{-4} in terms of a molar fraction; and the total amount of Mo, Nb and Ti that dissolve in the ferrite structure is not less than 1×10^{-3} in terms of a molar concentration.

6. A high-tensile-strength steel excellent in high temperature strength according to any one of claims 1 to 5, characterized in that the weld cracking susceptibility index PCM of said steel defined by the following expression is not more than 0.20%;

$PCM = C + Si/30 + Mn/20 + Cu/20 + Ni/60 + Cr/20 + Mo/15 + V/10 + 5 \times B$.

7. A high-tensile-strength steel excellent in high temperature strength according to any one of claims 1 to 6, wherein the steel further containing, in mass, one or more of Ni at 0.05 to 1.0%, Cu at 0.05 to 1.0%, Cr at 0.05 to 1.0%, and V at 0.01 to 0.1%.

8. A high-tensile-strength steel excellent in high temperature strength according to any one of claims 1 to 7, wherein the steel further containing, in mass: one or more of Ni at 0.05 to 1.0%, Cu at 0.05 to 1.0%, Cr at 0.05 to 1.0%, and V at 0.01 to 0.1%; and additionally one or more of Ca at 0.0005 to 0.004%, REM at 0.0005 to 0.004%, and Mg at 0.0001 to 0.006%.

9. A high-tensile-strength steel excellent in high temperature strength according to claim 7 or 8, characterized in that, in the high temperature range from 600°C to 800°C: said steel has such a strength as to satisfy the expression $p \geqq -0.0029 \times T + 2.48$ when the steel temperature T (°C) is within the range from 600°C to 800°C, wherein p is a stress drop ratio (a yield

stress at a high temperature/ a yield stress at room temperature) that is obtained by converting a yield stress normalized by using a yield stress at room temperature; said steel has a structure wherein the temperature (Ac_1) at which a single structure composed of bainite or a composite structure composed of ferrite and bainite at room temperature reversely transforms into austenite during high temperature heating corresponding to a fire higher than 800°C; the average circle equivalent diameter of prior austenite grains in said steel is not more than 120 μm; one or more of carbonitrides precipitated phases thermodynamically stable in said single structure composed of bainite or in said composite structure composed of ferrite and bainite is not less than 5×10^{-4} in terms of a molar fraction; and the total amount of Mo, Nb and Ti that dissolve in the ferrite structure is not less than 1×10^{-3} in terms of a molar concentration.

10. A method for producing a high-tensile-strength steel excellent in high temperature strength, characterized by comprising the steps of: reheating a casting or a slab having a steel composition according to any one of claims 1 to 9 in the temperature range from 1,100°C to 1,250°C; hot rolling it in the temperature range of not lower than 850°C while controlling the cumulative reduction ratio in the temperature range of not higher than 1,100°C to not less than 30%; finishing the hot rolling, cooling the hot-rolled steel sheet at a cooling rate of not lower than 0.3 K/sec. from the temperature of not lower than 800°C to the temperature of not higher than 650°C; and thus making the microstructure of the steel comprising a single structure composed of bainite or a composite structure composed of ferrite and bainite.

11. A high-tensile-strength steel excellent in high temperature strength, characterized by the steel comprising, in mass, C at not less than 0.005% to less

than 0.08%, Si at not more than 0.5%, Mn at 0.1 to 1.6%, P at not more than 0.02%, S at not more than 0.01%, Mo at 0.1 to 1.5%, Nb at 0.03 to 0.3%, Ti at not more than 0.025%, B at 0.0005 to 0.003%, Al at not more than 0.06%, and N at not more than 0.006%, with the balance consisting of Fe and unavoidable impurities; having a structure wherein the temperature (Ac_1) at which a composite structure composed of ferrite and bainite, the composite structure having a bainite fraction being in the range from 20 to 95% at room temperature, reversely transforms into austenite during high temperature heating corresponding to a fire is higher than 800°C; and having a low yield ratio.

12. A high-tensile-strength steel excellent in high temperature strength according to claim 11, wherein the steel further containing, in mass, one or more of Ni at 0.05 to 1.0%, Cu at 0.05 to 1.0%, Cr at 0.05 to 1.0%, and V at 0.01 to 0.1%.

13. A high-tensile-strength steel excellent in high temperature strength according to claim 11 or 12, wherein the steel further containing, in mass: one or more of Ni at 0.05 to 1.0%, Cu at 0.05 to 1.0%, Cr at 0.05 to 1.0%, and V at 0.01 to 0.1%; and additionally one or more of Ca at 0.0005 to 0.004%, REM at 0.0005 to 0.004%, and Mg of 0.0001 to 0.006%.

14. A method for producing a high-tensile-strength steel excellent in high temperature strength, characterized by comprising the steps of: reheating a casting or a slab having a steel composition according to any one of claims 11 to 13 in the temperature range from 1,100°C to 1,250°C; hot rolling it in the temperature of not lower than 850°C while controlling the cumulative reduction ratio in the temperature of not higher than 1,100°C to not less than 30%; finishing the hot rolling, cooling the resultant hot-rolled steel sheet at a cooling rate of not lower than 0.3 K/sec. from the temperature of not lower than 800°C to the temperature of not higher

than 650°C; thus making the microstructure of the steel comprising a single structure composed of bainite or a composite structure composed of ferrite and bainite; forming a microstructure wherein the temperature (Ac_1) at which a composite structure composed of ferrite and bainite, the composite structure having a bainite fraction being in the range from 20 to 95% at room temperature, reversely transforms into austenite during high temperature heating corresponding to a fire is higher than 800°C; and securing a low yield ratio.